

# PROJECT FACT SHEET

**CONTRACT TITLE:** Utilization of the Microflora Indigenous to and Present in Oil-Bearing Formations to Selectively Plug the More Porous Zones Thereby Increasing Oil Recovery During Waterflooding -- Class I

<b>ID NUMBER:</b> DE-FC22-94BC14962  <b>B&amp;R CODE:</b> AC1010000	<b>CONTRACTOR:</b> Hughes Eastern Corporation  <b>ADDR:</b> 403 Towne Center Blvd. Ste. 103 Ridgeland, MS 39157
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<b>PROJECT SITE</b> <b>CITY:</b> N.Blowhorn Creek Field <b>STATE:</b> AL <b>CITY:</b> Lamar County <b>STATE:</b> AL <b>CITY:</b> <b>STATE:</b>	<b>CONTRACT PERFORMANCE PERIOD:</b> 1/1/1994 to 6/30/1999  <b>PROGRAM:</b> Field Demonstration <b>RESEARCH AREA:</b> Class 1 <b>PRODUCT LINE:</b> RLE
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FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	1928	1928	3856
FISCAL YR 1999	0	0	0
FUTURE FUNDS	0	0	0
<b>TOTAL EST'D FUNDS</b>	1928	1928	3856

**OBJECTIVE:** Test the ability of indigenous microorganisms to preferentially plug the more porous zones of previously waterswept areas of the Carter sandstone in North Blowhorn Field, Lamar County, Alabama, thereby increasing oil recovery during waterflood. The project differs from other MEOR projects by using inorganic nutrients (fertilizers) and molasses to stimulate the indigenous microbes to grow rather than using injected microbes.

*Dec 1999*

**PROJECT DESCRIPTION:**

**Background:** This project is designed to test the ability of indigenous microorganisms to preferentially plug the porous zones of previously waterswept areas of the Carter sandstone in North Blowhorn Creek Field, Lamar County, Alabama, thereby increasing oil recovery during waterflood. Incremental production of 0.5 to 1.0 million barrels of oil is possible if the technology is expanded field wide. The project differs from other MEOR projects by using inorganic nitrogen and phosphorus fertilizer (recently an addition of molasses) to stimulate the growth of indigenous microorganisms. The nutrients are injected in carefully controlled concentrations and sequences to preclude overgrowth. Live cores from newly drilled wells were employed to validate the nutrient injection scheme and make any necessary adjustments to ensure maximum efficiency. The efficacy of the process was evaluated by comparison of results to injector producer complexes not receiving nutrient supplementation.

**Work to be Performed:** This project is designed to test the ability of indigenous microorganisms to preferentially plug the more porous zones of previously waterswept areas of the Carter sandstone in North Blowhorn Creek Field, Lamar County, Alabama, thereby increasing oil recovery during waterflood. Incremental production rate is 100 BOPD. As of Dec 1998, the production of 69,000 barrels of incremental oil resulted from the MEOR process. Incremental production of 0.5 to 1.0 million barrels of oil is possible if the technology is expanded field wide. Full production response was observed in FY 1998.

The project differs from other MEOR projects by using inorganic nitrogen and phosphorus fertilizer (recently an addition of molasses) to stimulate the growth of indigenous microorganisms. The nutrients are injected in carefully controlled concentrations and sequences to preclude overgrowth. Live cores from newly drilled wells were employed to validate the nutrient injection scheme and make any necessary adjustments to ensure maximum efficiency. The efficacy of the process was evaluated by comparison of results to injector producer complexes not receiving nutrient supplementation. The Technology Transfer Plan includes publications and short courses.

**PROJECT STATUS:**

**Current Work:** The 1998 Annual Report is being completed. This report reveals specific natural oil production decline curve graphs for each of the 22 production wells before and after the nutrient injection in to each of the 10 water flood injection wells of the project. A Workshop Technology transfer presentation on the "Microbial Enhanced Oil Recovery: North Blowhorn Creek Unit, Black Warrior Basin, Northwest Alabama" was presented November 4, 1998 in Jackson, Mississippi.

**Scheduled Milestones:****PHASE 2**

Nutrient injection	04/98
Analysis and evaluation of results	06/98

**PHASE 3**

Technology Transfer	06/99
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**Accomplishments:** Waterflood fluid diversion in the reservoir through stimulation/growth of in-situ microorganisms. Extended life of reservoir by 5 years with a total increase of 595,000 bbls of oil above natural decline. The 1997 annual report reveals that after 34 months of nutrient supplementation to 10 injection wells for 22 producing wells in the test patterns, 11 show positive response, 9 remain in natural decline and 2 show signs of improvement. Five wells have been drilled and placed on production. The cores indicate that much oil in the reservoir has been bypassed or unswept by historic water-flood. The amount of residual oil in the cores underscores the need for improving conventional water-flood technology in stratified reservoirs. Chemical and microbiological analysis of the live cores recovered in 1994 and 1996 have been completed. The live core flooding tests confirmed that indigenous bacteria in the subject reservoir rock could be stimulated to grow by supplying the bacteria with sufficient amounts of nitrogen and phosphorus. Restriction of flow through the cores was accomplished as predicted, and electron microscopy demonstrated numerous micro-organisms in the treated cores. Chemical, microbiological, and petrophysical baseline data on the wells in the test patterns (both control and test) were completed. The test pattern injection wells accepted the nutrient injection for over three years with no noticeable adverse effects on injectivity other than a gradual decline, which may be the result of microbial permeability restriction in the reservoir. Experimental technology; application has not spread to other fields, but has spread within North Blowhorn field. Because of positive results, project was expanded from 4 to 10 test injectors in July 1997. Since then 12 out of 19 producers have responded positively. Waterflood fluid diversion was successful in the reservoir through stimulation/growth of in-situ microorganisms. Project received the 1998 Hart's Award for Best Advanced Recovery Project in the Gulf Coast Section.